

Part 1: Written Response

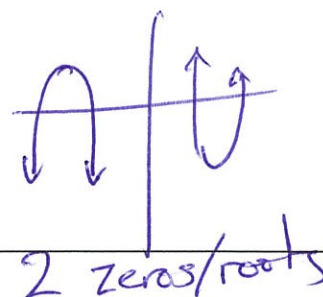
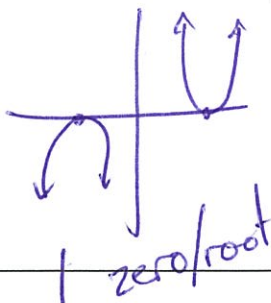
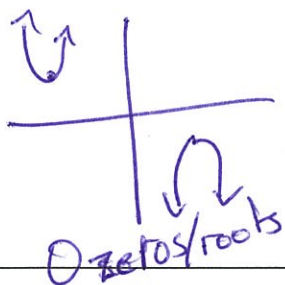
1. Linear, exponential, and quadratic functions have very different shapes when graphed. Describe the shape of each function **and** explain what causes each function to have that shape. (3 points)

Linear - straight line b/c the output grows by constant addition (which looks like multiplying the input)

Exponential - curved line b/c the output grows by constant multiplication (which looks like the input is the exponent)

Quadratic - U-shape (parabola) b/c the input is being squared

2. In the space below, draw a diagram to show the three possibilities for how many roots/zeros a quadratic function can have. Then, give a brief explanation in words.

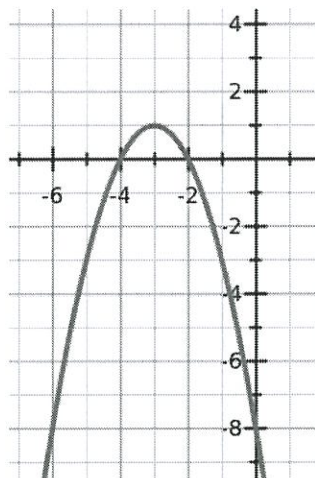


You should explain these in writing! 😊

Part 2: Characteristics of Quadratic Functions

3. Identify the characteristics of the following quadratic function.

Vertex: $(-3, 1)$
 Opens Up or Down? Down
 Vertex Maximum or Minimum? Maximum
 Axis of Symmetry: $x = -3$
 Domain: $(-\infty, \infty)$
 Range: $(-\infty, 1]$
 y-intercept: -8
 Zeroes: -4 and -2



4. Write out everything you know about the following three parabolas.

a. $f(x) = -(x - 5)^2 + 1$

- opens down
- same width as parent
- vertex: $(5, 1)$
- 2 zeros

b. $f(x) = 2(x - 5)(x + 1)$

- opens up.
- narrower than parent
- 2 zeros @ 5 and -1
- vertex: $(2, -18)$

c. $f(x) = -2x^2 + 8x - 1$

- opens down
- narrower than parent
- vertex $\left(\frac{-b}{2a} \rightarrow \frac{-8}{2(-2)} = \frac{-8}{-4} = 2\right)$ $\left(\frac{-2(2)^2 + 8(2) - 1}{-8 + 16 - 1} = 7\right)$ $(2, 7)$
- 2 zeros

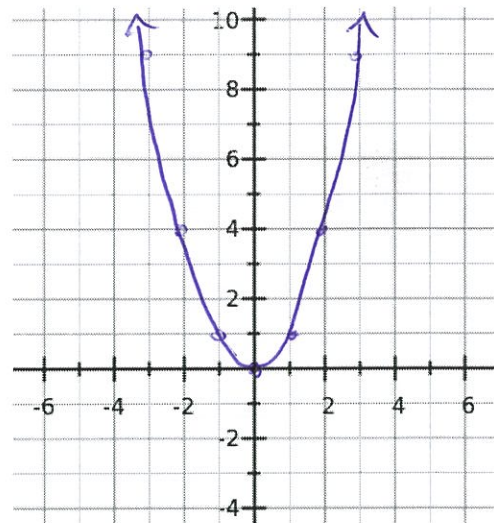
5. Write the equation of the **parent quadratic function**. Then state its vertex, whether it opens up or down, and graph it.

Parent Quadratic Function:

Equation: $y = x^2$

Vertex: $0, 0$

Opens Up or Down?

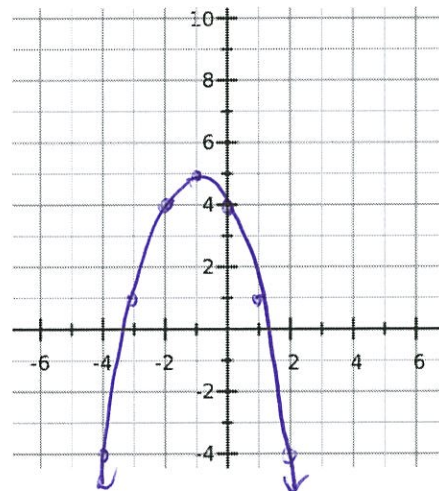


Part 3: Graphing Quadratics. Graph the following quadratic functions with **absolute precision**.

$$f(x) = -(x + 1)^2 + 5$$

$V: (-1, 5)$

$a = -1$



$$f(x) = 2(x - 1)(x - 5)$$

zeros: $1, 5$

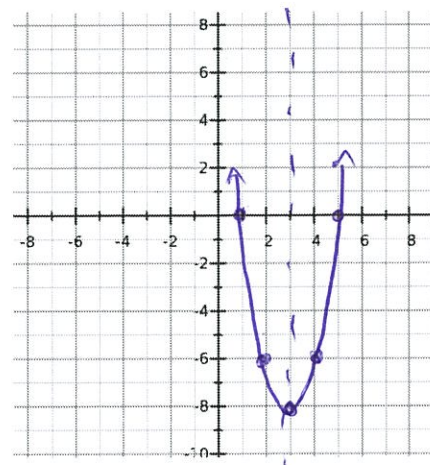
vertex $(3, ?)$

$$2(3-1)(3-5)$$

$$2(2)(-2) = -8$$

$(3, -8)$

$a = 2$



$$f(x) = x^2 + 2x - 6$$

$$\text{vertex: } \left(\frac{-2}{2(1)}, y \right)$$

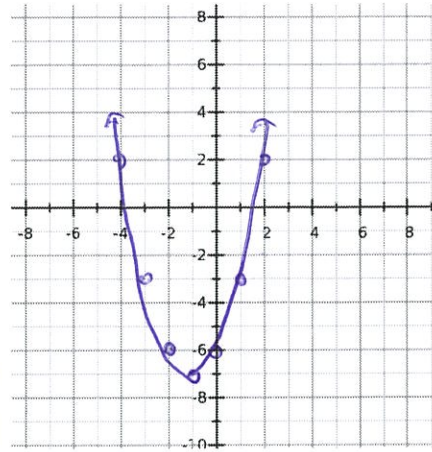
$$(-1, y)$$

$$(-1)^2 + 2(-1) - 6$$

$$1 - 2 - 6$$

$$-7$$

$$v: (-1, -7) \quad a=1$$

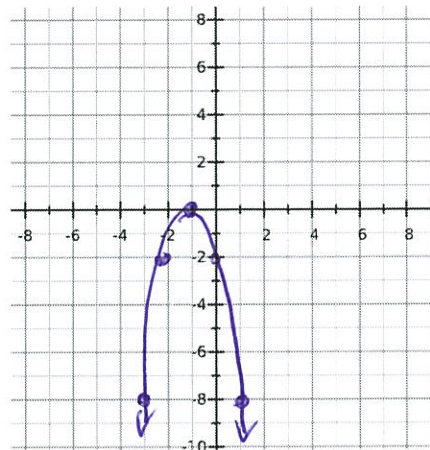


$$f(x) = -2(x+1)^2$$

vertex form!

$$v: (-1, 0)$$

$$a = -2$$



$$f(x) = -3x^2 + 12x + 1$$

$$\text{vertex: } \left(\frac{-12}{2(-3)}, y \right)$$

$$(2, y)$$

$$-3(2)^2 + 12(2) + 1$$

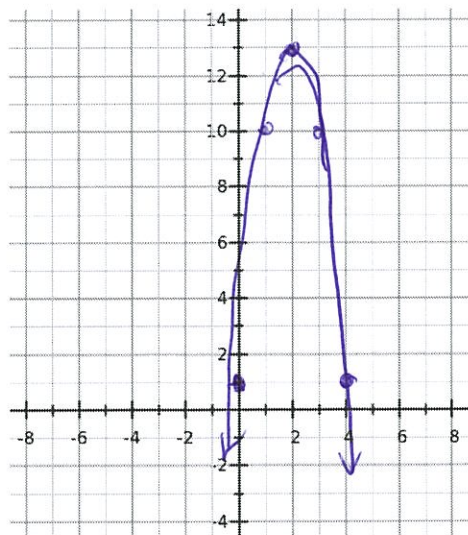
$$-12 + 24 + 1$$

$$12 + 1$$

$$13$$

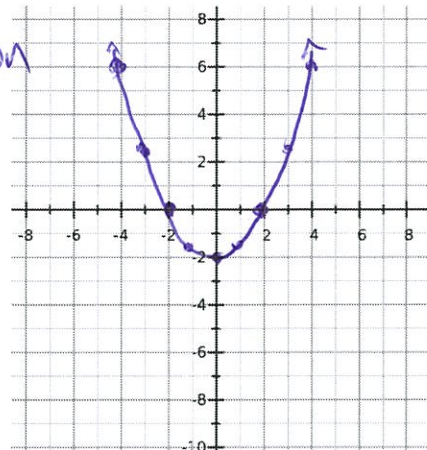
$$a = -3$$

$$\text{vert: } (2, 13)$$



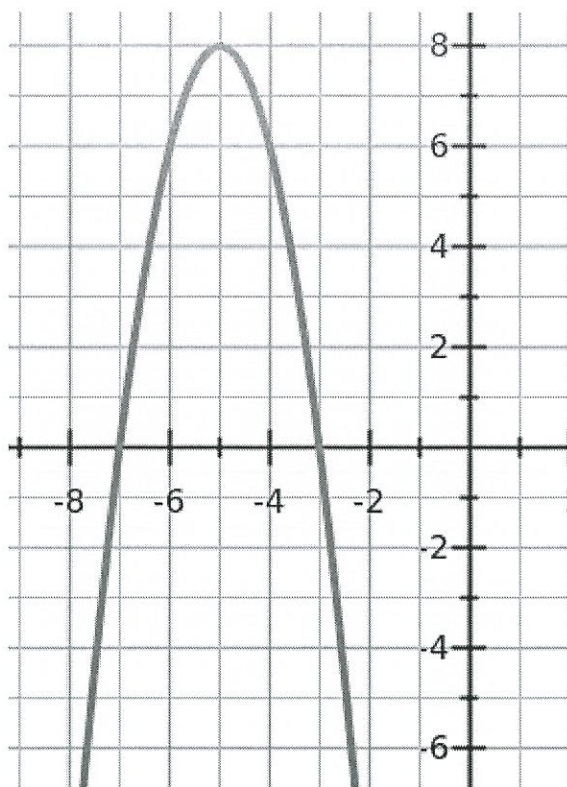
$$f(x) = 0.5x^2 - 2$$

parent shifted 2 down
 $a = 0.5$



Part 4 Writing Quadratic Equations. Write the equation for the following quadratic functions in all three forms.

Graph	Equations
	<p>Vertex Form: $f(x) = (x - 7)^2 - 1$</p> <p>Factored Form: $f(x) = (x - 6)(x - 8)$ $x^2 - 8x - 6x + 48$</p> <p>Standard Form: $f(x) = x^2 - 14x + 48$</p>



Vertex Form:

$$f(x) = -2(x+5)^2 + 8$$

Factored Form:

$$f(x) = -2(x+7)(x+3)$$

$$-2(x^2 + 10x + 21)$$

Standard Form:

$$f(x) = -2x^2 - 20x - 42$$

6. Write the equation for a quadratic function that meets the following characteristics:

- a. Has a vertex at (5, -2), opens down, and is very narrow.

$$y = -100(x-5)^2 - 2$$

- b. Has zeroes at $x = 5.1$ and $x = -2.7$, opens up and is very wide.

$$y = 0.1(x-5.1)(x+2.7)$$

- c. Compared to the parent quadratic function, this function is shifted three to the left, seven down, and is three times as narrow.

$$y = 3(x+3)^2 - 7$$

- d. Has a vertex at (3, 8) and its right arm passes through the point (6, 5).

$$\begin{aligned} f(x) &= a(x-3)^2 + 8 \\ f(6) &= a(6-3)^2 + 8 \\ 5 &= 9a + 8 \\ -3 &= 9a \\ -3 &= 9a \end{aligned}$$

$$\begin{aligned} -3 &= 9a \\ \frac{-3}{9} &= \frac{9a}{9} \\ -\frac{1}{3} &= a \end{aligned}$$

$$f(x) = -\frac{1}{3}(x-3)^2 + 8$$

Part 4: Zeroes and Vertexes

7. Write the coordinates for the vertex of the following two quadratic functions.

a. $f(x) = 2x^2 - 6x + 1$

$$\frac{-b}{2a}$$

$$\frac{6}{2(2)} = 1.5$$

$$2(1.5)^2 - 6(1.5) + 1$$

$$-4.5 + 1$$

$$-3.5$$

$$(1.5, -3.5)$$

b. $f(x) = -3x(x - 4)$

zeros: 0 and 4
vertex: (2, ?)

$$-3(2)(2-4)$$

$$-3(2)(-2) = 12$$

vertex:
(2, 12)

8. Identify the roots/zeroes of the following quadratic functions.

a. $f(x) = 2(x - 4)^2 - 18$

$$0 = 2(x - 4)^2 - 18$$

$$+18 \quad +18$$

$$18 = 2(x - 4)^2$$

$$\frac{18}{2} = \frac{2(x - 4)^2}{2}$$

$$\sqrt{9} = \sqrt{(x - 4)^2}$$

$$\pm 3 = x - 4$$

$$+4 \quad +4$$

$$7 \text{ and } 1 = x$$

b. $f(x) = 5x^2 - 20$

$$0 = 5x^2 - 20$$

$$+20 \quad +20$$

$$\frac{20}{5} = \frac{5x^2}{5}$$

$$4 = x^2 \quad x = \pm 2$$

c. $f(x) = -2(x - 7)(x + 3)$

$$0 = -2(x - 7)(x + 3)$$

$$x = 7, -3$$

d. $f(x) = 3x(x + 2)$

$$0 = 3x(x + 2)$$

$$x = -2 \text{ and } 0$$

9. How many roots/zeros will each of these quadratic functions have?

a) $f(x) = 2(x - 5)^2 - 3$

of roots/zeros: 2

b) $f(x) = x^2 + 7$

of roots/zeros: 0

c) $f(x) = -(x + 1)^2$

of roots/zeros: 1